

STAFF REPORT

CITY OF TRACY

DEMONSTRATION PHASE AQUIFER STORAGE AND RECOVERY PROJECT

SAN JOAQUIN COUNTY

Introduction

The City of Tracy is exploring the possibility of implementing a conjunctive use aquifer storage and recovery (ASR) project, which would involve the injection of treated drinking water obtained from the Delta-Mendota Canal into the aquifer underlying the City during times of abundant supply and extracting water from the aquifer in times of greater need. In preparation for this project, the City has proposed an ASR demonstration study to assess the feasibility of a full-scale project. The demonstration study would consist of four separate injection-storage-recovery (ISR) cycles, during which a specified volume of treated drinking water would be injected into the aquifer, the injected water would be stored in the aquifer for a specified amount of time, and then a specified volume of water would be extracted from the aquifer and discharged into the City drinking water system. The proposed rate of injection for the demonstration study would be approximately 1,000 gallons per minute. Each ISR cycle would be progressively longer than the previous cycle, with the first ISR cycle proposed to last 41 days, and the fourth cycle proposed to last 322 days. In total, approximately 260 million gallons of water would be injected into the aquifer during the entire life of the demonstration project. For the first three cycles, the City has proposed to extract the same volume of water injected. In an attempt to ensure that any degradation or pollution in the groundwater originating from the project is removed at the end of project, the City has proposed to extract a sufficient volume during the final ISR cycle so that the total volume extracted during the entire demonstration project is twice the total volume injected during the project.

Staff Concerns

Staff has several significant concerns regarding the proposed ASR demonstration project.

The first is a concern regarding water quality issues. The Report of Waste Discharge indicates that the treated drinking water proposed for injection contains trihalomethanes (THMs) and haloacetic acids (HAAs) at levels slightly under the State of California maximum contamination levels (MCLs) for drinking water for those classes of constituents, while no THMs or HAAs were found in the aquifer itself. In addition, the reported concentrations of THMs and HAAs suggest that levels of specific THMs and HAAs may well exceed other water quality objectives that are lower than MCLs. For example, the City has reported that the treated drinking water was found to contain 51.8 micrograms per liter (mg/l) of total THMs. THMs consist of only four constituents, and generally, in chlorinated drinking water from surface water sources, chloroform, a carcinogenic substance, is the most prevalent of the THMs. While the concentration of total THMs in the treated water is less than the US EPA Primary MCL of 80 ppb, the concentration of chloroform is probably well above the applicable health-based limits for chloroform, which is the Cal/EPA Cancer Potency Factor of 1.1 ppb. Therefore, it is clear that the demonstration project will result not only in degradation of the groundwater, but will probably also result in pollution of the groundwater. In fact, the City has stated that, during the

project, THMs and HAAs will definitely be detected in two monitoring wells located approximately 35 and 75 feet from the point of injection.

There may also be other disinfectant byproducts or constituents of concern, such as those present in the source water (volatile organics, pesticides, etc.), in the injected water that have not yet been analyzed for.

A second concern is the length of the proposed demonstration project, and the volume of water proposed for injection during the project. The duration of the entire four ISR cycles is proposed to be 626 days in length, and approximately 260 million gallons of treated drinking water are proposed to be injected during the project. This is a project of significant length and a significant volume of water to be injected, and it is staff's opinion that there is insufficient information available at this time to justify the permitting of the entire four cycles of the demonstration project. A more prudent approach would be to permit only the two shortest cycles at this time and then evaluate the results of those cycles before permitting the remaining two longest cycles.

The City has proposed to extract 200 times the volume of water injected during the project in order to ensure that no residual degradation or pollution will remain in the aquifer upon completion of the demonstration project. However, the bulk of the water would be extracted during the final ISR cycle. During each of the first three ISR cycles, only as much water as is injected would be extracted. The City has provided a hydrogeologic model that indicates that, by extracting 200 times the volume injected, all water injected during the demonstration project would be extracted. However, the model also indicates that, for the first three cycles, the recovery cycles would not capture all injected water. It is staff's opinion that a more conservative approach should be taken so that field verification and evaluation of the model can be accomplished for the two shortest cycles before permitting the two long cycles. This conservative approach is to require that 200% of injected volume be extracted at the end of each of the first two ISR cycles.

The City has installed three wells for the demonstration project, an injection well (ASR Demonstration Well) and two monitoring wells. However, the monitoring wells are only 35 and 75 feet from the injection well. The City has stated that the two monitoring wells are well within the area of influence of the injection plume that will be created even during the first ISR cycle. However, if staff is to assess the validity of the hydrogeologic model and monitor compliance with the requirements of this resolution to ensure that any detrimental effects to groundwater created by this project are known and mitigated to the extent feasible, additional monitoring wells are required at the anticipated injection front of each ISR cycle. Additional wells are also necessary in order to determine the long term implications of the proposed third and fourth ISR cycles of the demonstration project and of an eventual full scale project, and whether an alternative to chlorine treatment of the drinking water supply or pretreatment to remove disinfection byproducts and other constituents of concern is required in the future.

Resolution Requirements

Because of the concerns described above, this resolution will cover only the first two of the ISR cycles. The first cycle is anticipated to last approximately 45 days, and the second 80 to 90 days. A total of approximately 65 million gallons of water would be injected during those two cycles. The resolution requires the extraction of 200 times the volume of water injected during each cycle in order to ensure that the injection plume for each cycle is captured and removed during the respective recovery cycle. The resolution also prohibits the creation of a condition of pollution beyond the anticipated injection front during each cycle, and anywhere in the aquifer at the conclusion of each cycle. If pollution is found, then the City must implement a cleanup contingency plan.

In order to identify additional disinfection byproducts or other constituents of concern that may be in the injected drinking water, the resolution also requires the City to conduct additional monitoring of the treated drinking water and the aquifer and to submit an *Injection Water Quality Characterization Report* prior to initiating the demonstration project.

Finally, the resolution requires the submittal of a *Monitoring Well Installation Workplan* and installation of the wells prior to initiating the project in order to provide an adequate monitoring network. The Monitoring and Reporting Program of the resolution requires the monitoring of the treated injected water and the groundwater. Groundwater must be monitored several times during each ISR cycle. A monitoring report is required after the conclusion of each ISR cycle. Monitoring reports must discuss the water sampling and analytical results associated with each cycle, summarize important findings of the cycle monitoring relevant to the conditions of the resolution, and clearly evaluate and discuss compliance with the conditions of the resolution.

Comment Letters

A tentative waiver resolution was issued for public comment on 10 June 2004. Two comment letters were received and both are summarized below.

City of Tracy

The City objected to several aspects of the tentative waiver. One of their major objections was to limiting the waiver to only the first two of the four proposed ISR cycles. The City stated that all four cycles were necessary to make any conclusions regarding the fate and transport of the injected water and the constituents it contains. They also said that limiting the resolution to only two cycles was not necessary because the City intended to submit interim reports after each ISR cycle that would provide the Board an opportunity to terminate or modify the project if serious threats to water quality were found.

The City also reiterated the point originally made in their Report of Waste Discharge that 200% recovery of the injected water at the conclusion of the fourth ISR cycle would ensure the removal of any constituents of concern.

The City objected to a requirement to notify the Board if THMs or HAAs were detected in any monitoring well during the project. The City stated that THMs and HAAs would definitely be

detected in the monitoring wells already installed, because of their proximity to the point of injection. Staff has removed this requirement.

The City objected to several aspects of the tentative Monitoring and Reporting Program. The first was to the list of analytes to be monitored and to the monitoring frequency of both the treated injected water and groundwater. The second was the requirement that both the injection well and the nearby monitoring wells be monitored simultaneously. Staff has taken these comments under consideration and has modified the MRP in an attempt to accommodate the City's concerns, while still ensuring that sufficient data are collected.

California Department of Health Services

The Department of Health Services (DHS), Drinking Water Branch commented on several aspects of the tentative resolution. DHS first questioned the general approach of the resolution, particularly the fact that the resolution allows degradation or pollution of the groundwater without requiring treatment of the injection water to remove THMs, HAAs, or other constituents of concern prior to injection. DHS stated that the technology to remove most of the organic contaminants that may be in the injection water is well developed and readily available, and recommended that granular activated carbon treatment should be required prior to injection.

DHS also indicated that many communities in the vicinity of Tracy are solely dependent on groundwater and that it is important to assure that this project does not degrade the quality of water available for subsequent extraction and use. It also stated that the Board has taken enforcement action against other dischargers in the Tracy area for contaminating groundwater with chloroform (a THM) and there appears to be an inconsistency in mandating remediation for one set of dischargers releasing THMs, while permitting another to discharge significant amounts of the same contaminant into the groundwater.

The letter also addressed two issues related to the fate and transport of disinfection byproducts in the aquifer. The first is that if constituents of concern are not found or are found at insignificant levels in the aquifer during the monitoring of the demonstration project, it may not be because those constituents are not present in significant concentrations, but because they have been adsorbed to the aquifer matrix. If this were the case, operation of an ASR system over a longer period of time could saturate the adsorptive capacity of the matrix, at which point, the constituents could be released to the groundwater at significant concentrations. Alternatively, if constituents of concern are not found or are found at insignificant levels during the monitoring of the demonstration project, it may be due to metabolism of constituents by microorganisms. This process could produce degradation byproducts of concern. DHS recommended that the nature of such byproducts be quantified and qualified to assure that unacceptable degradation byproducts in the groundwater do not result.

DHS also recommended that the project include a sufficient number of properly located monitoring wells to provide proper determination of groundwater gradient during the project. In addition, because many constituents of concern that could potentially be found in the injection water are organically based, and because monitoring for all potential constituents of concern is

not practical, it was recommended that total organic carbon be added to the monitoring program's analytical suite in order to provide an indicator of the balance between organic constituents injected versus organic constituents extracted.

Recommendation

Staff recommends that the Board adopt the Resolution waiving WDRs for the first two ISR cycles of the City of Tracy ASR demonstration project.